



August 23, 2022

Mr. Todd Struttman  
Los Alamos Technical Associates, Inc.  
756 Park Meadow Rd.  
Westerville, OH 43081

**RE: Safety Review of the Asphalt Recycling Project**

Dear Mr. Struttman:

As requested, Safex has conducted the final safety review of the asphalt recycling process, at the C6 Zero Facility Iowa, based on the information provided to us.

Safex reviewed the process with Todd Struttman through meetings and collected information from the documentation provided. Safex identified the potential emission sources of the flammable vapor(s) and the likelihood of the presence of flammable vapor(s) in each area. The recommendations on hazardous location classification, provided in this memo, are based on our understanding of the process and the chemical properties provided, and based on the assumption that designed engineering controls are achieved and are in accordance with the NFPA 30 Flammable and Combustible Liquids, and NFPA 70, National Electrical Code, Article 500 for hazardous (classified) locations.

References to the applicable NFPA standards are provided for further information.

## 1. Chemical Property

Flammable Liquid Class I	Combustible Liquid Class II	Combustible Liquid Class III
<u>Production Fuel (Product)</u> Flash point -19°C (-2.2°F) Vapor pressure 35 mmHg @ 20°C Auto ignition 285°C (545°F) Initial boiling point 69°C (156°F)	<u>Kanitsu</u> Flash point 40.11°C (104.2 °F) Vapor pressure 0.56 mmHg @ 20°C Initial boiling point 179°C (354.2 °F) Auto ignition 445°C (833 °F) LFL 0.8% @ 25°C 760 mmHg UFL 5.9% @ 25°C 760 mmHg  <u>Kanitsu + 5% soybean oil (Lite oil)</u> Physical and chemical properties unknown	<u>B100 (use Marathon B100 SDS<sup>1</sup>)</u> Flash point 288-366°C (550-690°F) Boiling point 171-199°C (340-390°F) Auto ignition 374-449°C (705-840°F)  <u>Soybean Oil (use Marathon SDS<sup>2</sup>)</u> Flash point 282°C (540°F) Auto ignition 445°C (833°F)

### Max Equilibrium Concentration (MEC) Calculation

$$MEC (\%) = \frac{VP}{TP} = \frac{0.56 \text{ mmHg}}{760 \text{ mmHg}} \times 10^2 = 0.07\%$$

*VP = vapor pressure*

*TP = total pressure (atmospheric)*

Based on the calculation, under standard atmospheric pressure, Kanitsu's MEC is 0.07%, which is less than the Lower Flammability Level (LFL) of 0.8%. At the equilibrium concentration, Kanitsu vapor concentration will be outside the flammable range. However, flammable range expands at higher temperatures. The risk of inflammation will need to be re-evaluated if the heat processes are involved.

<sup>1</sup> Marathon Petroleum Biodiesel B100

<https://www.marathonbrand.com/content/documents/brand/sds/0282MAR019.pdf>

<sup>2</sup> Marathon Petroleum Soybean Oil

<https://www.marathonbrand.com/content/documents/brand/sds/0347MAR019.pdf>

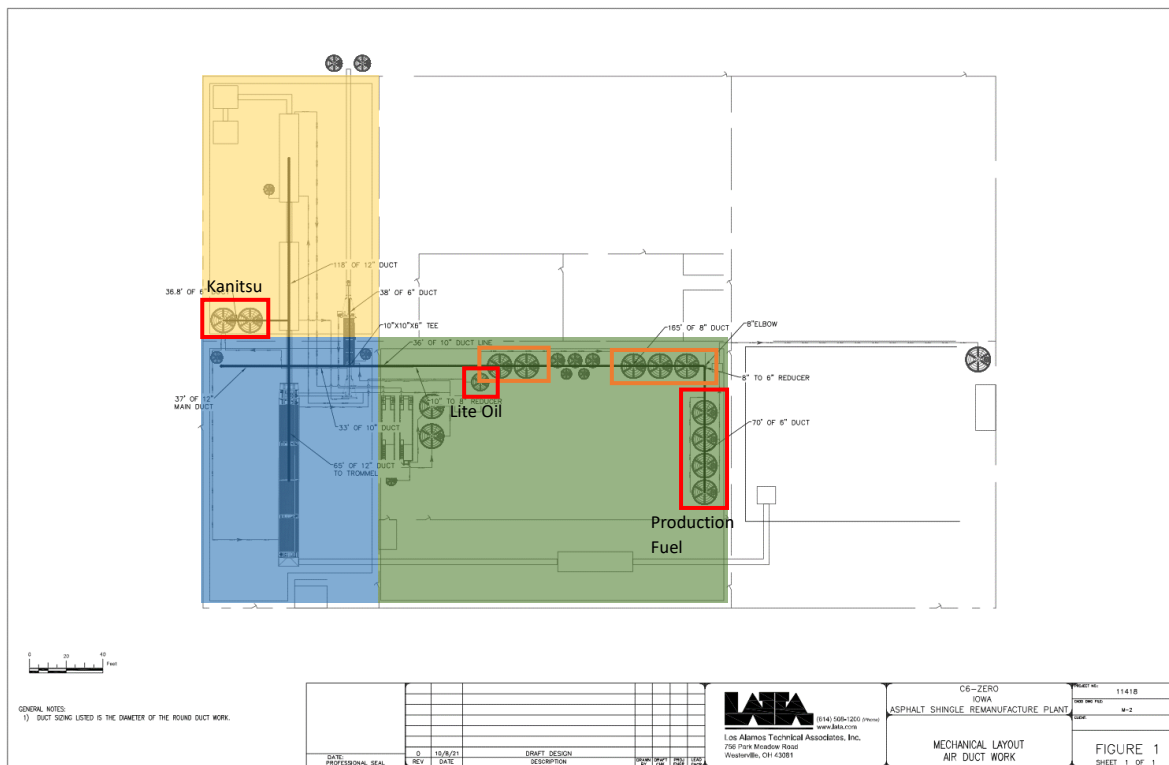
The Product Fuel's MEC is 4.6%; however, the LFL and Upper Flammable Limit (UFL) are not reported.

The SDS also listed Kanitsu as Class 2 Oxidizer. The emission control system design should avoid mixing Kanitsu vapor with Production Fuel vapor.

## 2. Ignition Source Precautions

- Hot surface – maximum surface temperature (NFPA 70, Article 500)
  - T2D (maximum 215°C)
- Electrical sparks, static discharge – intrinsically safe, bonding and grounding (NFPA 70, Article 501)
- Mechanical sparks (friction and impact)

## 3. Hazardous Locations



Based on the chemical property and the mechanical layout, Safex identified one location as Class 1 Division 1 in the facility.

Class 1: flammable liquid and vapor

- Division 1: exist under normal operation
- Division 2: not likely to exist during normal operation

Assumption: All systems are enclosed, all storage tanks are sealed, emission control system is fully functional.

Class 1 Division 1	Class 1 Division 2
<ul style="list-style-type: none"><li>• Inside emission control system ductwork</li></ul>	<ul style="list-style-type: none"><li>• Yellow area: ventilation failure</li><li>• Blue area: ventilation failure</li><li>• Green area: leak or spill, ventilation failure</li></ul>

#### 4. Processing Equipment and System

Equipment (handle Class 1 liquids)

- Oil water separator
- Pipeline to Production Fuel storage tank

Location (NPFA 30, Chapter 17)

- Location of the equipment should follow the table below (17.4.3)
- Each piece of equipment must be separated from unrelated plant facilities by either of the following:
  - (1) 25 ft (7.6 m) clear spacing
  - (2) A wall having a fire resistance rating of not less than two hours and explosion resistance consistent with the expected hazard

Table 17.4.3 Location of Process Vessels with Respect to Property Lines, Public Ways, and the Nearest Important Building on the Same Property — Protection for Exposures Is Provided

Vessel Maximum Operating Liquid Capacity (gal)	Minimum Distance (ft)							
	From Property Line that Is or Can Be Built upon, Including Opposite Side of Public Way				From Nearest Side of Any Public Way or from Nearest Important Building on Same Property that Is Not an Integral part of the Process			
	Stable Liquid Emergency Relief*		Unstable Liquid Emergency Relief*		Stable Liquid Emergency Relief*		Unstable Liquid Emergency Relief*	
	Not Over 2.5 psi	Over 2.5 psi	Not Over 2.5 psi	Over 2.5 psi	Not Over 2.5 psi	Over 2.5 psi	Not Over 2.5 psi	Over 2.5 psi
275 or less	5	25	50	100	5	25	50	100
276 to 750	10	25	50	100	5	25	50	100
751 to 12,000	15	25	50	100	5	25	50	100
12,001 to 30,000	20	30	50	100	5	25	50	100
30,001 to 50,000	30	45	75	120	10	25	50	100
50,001 to 100,000	50	75	125	200	15	25	50	100
Over 100,000	80	120	200	300	25	40	65	100

For SI units, 1 gal = 3.8 L; 1 ft = 0.3 m; 1 psi = a gauge pressure of 6.9 kPa.

Note: Double all of above distances where protection for exposures is not provided.

\*Gauge pressure.

### Other Related Standards

- Storage tanks – Chapter 21/22
- Storage building – Chapter 24
- Piping system – Chapter 27
- Bulk loading and unloading – Chapter 28

### 5. Recommendations

- Confirm if all aspects of the facility building structure and equipment are in compliance with NFPA 30 Chapter 17-28 standards.
- Install equipment that is in compliance with the NFPA 70, National Electrical Code, Article 501 for Class 1 hazardous locations.

Sincerely,  
**SafeX**

*Irene Wang*

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Project Manager

Reviewed by:

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